

# Study suggests coral restoration projects can help restore fish communities

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Staghorn coral (*Acropora cervicornis*). Credit: Wikipedia, CC BY 2.5

Spending hours a day diving in and around the coral reefs off St. Croix in the U.S. Virgin Islands sounds like the stuff of a dream vacation, but for Annie Opel it was serious business.

As part of her undergraduate thesis, Opel spent much of her time in the

water working on a study showing efforts to restore [coral reefs](#) have a positive impact on local fish populations, both in the short term and over time. The study is published in the December issue of *Marine Biology* with Opel as first author, a rare accomplishment for an undergraduate.

"Reefs are not only biologically important - more than 4,000 species of fish rely on these ecosystems - but they're also really important for humans," Opel said. "We depend on them for commercial and recreational fisheries, they provide protection for coastal communities and they bring in a great deal of money through tourism.

"But right now they're threatened by a number of anthropogenic inputs, from pollution to the effects of climate change," Opel said. "Coral reefs have experienced bleaching and mass mortality all over the world, causing ecosystem degradation that affects the marine life that rely on the reefs to survive."

While there have been efforts to address the problem by transplanting corals grown in underwater "nurseries" to damaged reefs, the effectiveness of such restoration projects on Caribbean reefs has never been rigorously studied, Opel said.

"In St. Croix, they've been restoring corals since 2009," Opel said. "(But) no one is really looking at what's happening after the fact...so no one knows if this is an efficient way to restore (those) reef systems."

What she found, Opel said, is that in as little as a week after creating experimental coral beds, significantly more fish and a greater diversity of species could be found. The study also showed that, over time, the fish community changed as additional species began visiting the sites.

"Overall, it's a success story - we out-planted corals and there were more fish," she said. "That's really exciting and something people took for

granted in these restoration projects, but no one had quantified it before. I think it's going to be interesting for future studies to use this as a benchmark to know what's going on after transplanting corals."

The project was a natural fit for Opel, as it allowed her to combine both her interest in ocean conservation and the sciences.

During a gap year after finishing high school, Opel spent time in St. Croix, working with The Nature Conservancy on coral [restoration projects](#). As a sophomore at Harvard, she joined the lab of Colleen M. Cavanaugh, the Edward C. Jeffrey Professor of Biology in the department of Organismic and Evolutionary Biology, and later proposed the coral study for her senior honors thesis. Prof. Cavanaugh took on the challenge of advising Annie on her own independent research with the help of her Post-doctoral Fellow, Dr. Joey Pakes Nelson, an invertebrate biologist and ecologist, and a former Post-doc, Dr. Randi Rotjan, a coral reef expert now an assistant professor at Boston University.

"This work was really cool for a variety of reasons," said postdoctoral fellow Joey Pakes Nelson. "As a global community, we spend a lot of money on coral reef restoration, but few studies describe how this practice affects the [reef](#) community, so Annie's work provides justification for investments in this type of conservation.

"When it came time to choose a thesis topic, Annie wanted to combine her love of research with her love of coral," she added. "She had great resources because of her work in the Nature Conservancy, she knew about transplanting corals, she had diving experience and she had a great question."

But having a great idea, however, didn't make it any easier to execute.

"I went down to St. Croix in March over spring break and in

collaboration with other researchers, out-planted four two-by-two meter plots of an endangered species of coral found in the Caribbean called *Acropora cervicornis*," Opel said. "We also designated control plots ten and 20 meters away."

Opel returned to the island at the end of the academic year to plant four additional plots and began the hard work of collecting data almost entirely on her own.

"Each survey day, I spent two hours underwater where I took five minute surveys on each of my 16 plots. I sat there with underwater paper and a clipboard and I would basically mark every fish I saw for that five minutes," Opel said. "It was a steep learning curve, because I needed to learn how to identify every species of fish by sex and age before I started taking my surveys. I took surveys three times a week for all 16 plots, and I counted something like 15,000 fish in total, so it was a lot of sitting underwater in my bright orange wetsuit counting and identifying fish."

One of the most challenging parts of the project, she said, was finding partners to accompany her on dives.

"For safety reasons, you always dive with another person," Opel said. "But it's not like I had an assistant or anyone working with me, so I had to crowdsource my volunteers. I asked around at local dive shops in St. Croix and got put in contact with a lot of great people that wanted to help me with my research. One day my dad even came with me, so that was really special. One of my favorite parts of the paper is the acknowledgments, because I got the chance to thank all the volunteer divers and all of the people that helped make this project happen. And I am really thankful to have had three rock star female scientists to mentor me through this academic journey".

Provided by Harvard University

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